

a second switch for selectively discharging the load;
plural capacitive elements; and
switch means for selectively connecting each of the capacitive elements to the capacitive load to gradually charge or discharge the capacitive load,
whereby energy is recovered from the capacitive load and whereby the recovered energy is always stored substantially only in capacitance.

11 (amended). A method for efficiently charging and discharging a capacitive load from a single voltage source including the steps of:

C1 providing a first switch for selectively connecting the voltage source to the load;
providing a second switch for selectively providing a short across the load;
providing plural capacitive elements;
providing plural third switches for selectively connecting each of the capacitive elements to the capacitive load; and
selectively activating the first, second and third switches to gradually charge or discharge the capacitive load,
whereby energy is recovered from the capacitive load and whereby the recovered energy is always stored substantially only in capacitance.

C2 12 (twice amended). A system for charging and discharging a capacitive load, comprising:

a first switch to charge the load;
a second switch to discharge the load;
a capacitive element; and

a switch assembly to connect and disconnect the capacitive element to and from the capacitive load to gradually charge or discharge the capacitive load in conjunction with the operation of said first switch and said second switch,

whereby energy is recovered from the capacitive load and whereby the recovered energy is always stored substantially only in capacitance.

26 (twice amended). A system for charging and discharging a capacitive load from a

voltage source comprising:

a first switch to charge the load;

a second switch to discharge the load;

a capacitive element; and

a switch assembly to connect and disconnect the capacitive element to and from the capacitive load to charge or discharge the capacitive load in a plurality of steps,

whereby energy is recovered from the capacitive load and whereby the recovered energy is always stored substantially only in capacitance.

27 (twice amended). A method for charging and discharging a capacitive load from a voltage source comprising:

charging the capacitive load with the voltage source;

discharging the capacitive load by connecting the capacitive load through a switch assembly to at least one capacitive element; and

disconnecting the at least one capacitive element from the capacitive load,

whereby energy is recovered from the capacitive load and whereby the recovered energy is always stored substantially only in capacitance.

29 (twice amended). A method for charging and discharging a capacitive load from a voltage source comprising:

charging the capacitive load with the voltage source;

temporarily storing the charge from the capacitive load for use in a subsequent charging step in a capacitive element; and

disconnecting the capacitive element from the capacitive load,

whereby energy is recovered from the capacitive load and whereby the recovered energy is always stored substantially only in capacitance.

30 (thrice amended). A system for charging and discharging a load with a source comprising:

a first switch to charge the load;

a second switch to discharge the load;

a capacitive element; and

a third switch to selectively connect and disconnect the capacitive element to and from the load,

whereby energy is recovered from the load and is always stored substantially only in capacitance.

31 (thrice amended). A system for at least one of charging and discharging a capacitive load in N steps, N being greater than 1, comprising:

N-1 capacitive devices; and

a first switching device operable to selectively couple and de-couple the N-1 capacitive devices to and from the capacitive load during at least one of a charging and a discharging of the capacitive load.

C4 whereby energy is recovered from the capacitive load and whereby the recovered energy is always stored substantially only in capacitance.

C5 38 (twice amended). A system for at least one of charging and discharging a capacitive load comprising:

a plurality of capacitive devices; and

a first switching device operable to selectively couple and de-couple the plurality of capacitive devices to and from the capacitive load during at least one of a charging and a discharging of the capacitive load,

whereby energy is recovered from the capacitive load and whereby the recovered energy is always stored substantially only in capacitance.

C6 45 (twice amended). A method for at least one of charging and discharging a capacitive load comprising:

selectively coupling and de-coupling a capacitive device to and from the capacitive load to cause at least one of the charging and the discharging of the capacitive load to occur in a plurality of steps,

whereby energy is recovered from the capacitive load and whereby the recovered energy is always stored substantially only in capacitance.

46 (thrice amended). A method of charging and discharging a capacitive load in N steps, N being greater than 1, comprising:

charging the capacitive load;

discharging the capacitive load;

storing at least a portion of a charge discharged during the discharging step in N-1 capacitive devices for use in a subsequent charging step; and

disconnecting each of the capacitive devices from the load at some point during the N steps.

whereby energy is recovered from the capacitive load and whereby the recovered energy is always stored substantially only in capacitance.

C4 47 (twice amended). A system for charging and discharging a capacitive load, comprising:

a discharge switch to discharge the load;

N-1 capacitive elements, N being greater than 1;

a switch assembly including N-1 switches to respectively couple and de-couple the N-1 capacitive to and from the load to charge or discharge the load; and

an Nth switch to couple the load to a power supply voltage.

whereby energy is recovered from the capacitive load and whereby the recovered energy is always stored substantially only in capacitance.

C7 51 (twice amended). A system for charging and discharging a capacitive load, comprising:

a discharge switch to discharge the load;

N-1 capacitive elements, N being greater than 1;

a switch assembly including N-1 switches to respectively couple and de-couple the N-1 capacitive elements to and from the load to charge or discharge the load in N-1 steps; and

an Nth switch to couple the load to a power supply voltage.

whereby energy is recovered from the capacitive load and whereby the recovered energy is always stored substantially only in capacitance.

52 (twice amended). A system for charging and discharging a capacitive load, comprising:

a discharge switch to discharge the load;

N-1 capacitive elements, N being greater than 1;

67 a switch assembly including N-1 switches to respectively couple and de-couple the N-1 capacitive elements to and from the load, said N-1 switches being closed and opened in succession for charging or discharging the load in N-1 steps; and

an Nth switch to couple the load to a power supply voltage,

whereby energy is recovered from the capacitive load and whereby the recovered energy is always stored substantially only in capacitance.

53 (twice amended). A system for charging and discharging a capacitive load, comprising:

a discharge switch to discharge the load;

N-1 capacitive elements, N being greater than 1;

a switch assembly including N-1 switches to respectively couple and de-couple the N-1 charge storage elements to and from the load for charging or discharging the load; and

an Nth switch to couple the load to a power supply voltage;

wherein first leads of each of said N-1 capacitive elements are connected together and wherein second leads of each of said N-1 capacitive elements are connected to respective ones of said N-1 switches.

whereby energy is recovered from the capacitive load and whereby the recovered energy is always stored substantially only in capacitance.

54 (twice amended). A system for at least one of charging and discharging a capacitive load in N steps, comprising:

C1 N-1 capacitive elements, N being greater than 1; and

a switch assembly to selectively couple and de-couple the N-1 charge storage elements to and from the capacitive load,

whereby energy is recovered from the capacitive load and whereby the recovered energy is always stored substantially only in capacitance.

62 (twice amended). A system for at least one of charging and discharging a capacitive load, comprising:

C8 a plurality of capacitive elements; and

a switch assembly to selectively couple and de-couple the capacitive elements to and from the capacitive load one at a time,

whereby energy is recovered from the capacitive load and whereby the recovered energy is always stored substantially only in capacitance.

67 (twice amended). A system for at least one of charging and discharging a capacitive load, comprising:

C9 a plurality of capacitive elements, each having a first lead and a second lead; and

a plurality of switches to selectively couple and de-couple the capacitive elements to and from the capacitive load,

wherein all of the first leads of the capacitive elements are connected together and wherein each of the second leads of the capacitive elements is connected to a respective one of the switches.

whereby energy is recovered from the capacitive load and whereby the recovered energy
is always stored substantially only in capacitance.

71 (twice amended). A system for at least one of charging and discharging a capacitive
load in a plurality of steps, comprising:

a plurality of capacitive elements, each capable of storing an amount of charge
corresponding to a voltage across the capacitive element; and

a plurality of switches to selectively couple and de-couple the capacitive elements to and
from the capacitive load,

wherein the voltages across said capacitive elements are self-stabilizing over a full
charge/discharge cycle,

whereby energy is recovered from the capacitive load and whereby the recovered energy
is always stored substantially only in capacitance.

72 (twice amended). A system for at least one of charging and discharging a capacitive
load, comprising:

a capacitor having a first end coupled to a first potential source and a second end;

a first switch having a first end coupled to the second end of the capacitor and a second
end coupled to the capacitive load, the second end of the capacitor not being coupled to any other
component;

a second switch having a first end coupled to the first potential source and a second end
coupled to the second end of the first switch and the capacitive load; and

a third switch having a first end coupled to a second potential source and a second end
coupled to the second end of the first switch, the second end of the second switch, and the
capacitive load.

whereby energy is recovered from the capacitive load and whereby the recovered energy is always stored substantially only in capacitance.

73 (amended). A system for charging and discharging a capacitive load comprising:

one or more capacitors; and

a switching system coupled to said capacitors and the load, said switching system configured to cause the capacitors to couple to the load; to cause the capacitors to derive substantially all of their charge from only the load during the discharging of the load; and to cause the capacitors to charge the load with charge from the capacitors.

whereby energy is recovered from the capacitive load and whereby the recovered energy is always stored substantially only in capacitance.

74 (amended). A method for charging and discharging a capacitive load comprising:

coupling one or more capacitors to the load;

charging the capacitors only with charge delivered from the load; and

charging the load with charge from the capacitors.

whereby energy is recovered from the capacitive load and whereby the recovered energy is always stored substantially only in capacitance.

75 (amended). A system for charging and discharging a capacitive load in N steps comprising:

N-1 capacitors, N being greater than 1; and

N-1 switches, each having a first and a second connection, each of said first connections being connected to only one of said capacitors,

whereby energy is recovered from the capacitive load and whereby the recovered energy is always stored substantially only in capacitance.

76 (amended). A method for repeatedly charging and discharging a capacitive load in a plurality of steps comprising:

selectively coupling one or more capacitors to the capacitive load during a first charging cycle and not transferring any substantial charge from the capacitors to the load during the first charging cycle; and

selectively coupling the capacitors to the load during a discharging cycle and transferring substantial charge to the capacitors from the load during the discharging cycle,

whereby energy is recovered from the capacitive load and whereby the recovered energy is always stored substantially only in capacitance.

79 (amended). A method for repeatedly charging a capacitive load that is discharged between charges comprising:

charging the capacitive load in only one step during a first charging cycle; and

charging the capacitive load in a plurality of steps after the first charging cycle,

whereby energy is recovered from the capacitive load and whereby the recovered energy is always stored substantially only in capacitance.

Please add new Claim 81 as follows:

12 (new). A system for charging and discharging a capacitive load comprising:

a first switch system that opens and closes a circuit between the capacitive load and a substantially constant first voltage potential;

a second switch system that opens and closes a circuit between the capacitive load and an energy storage system that always stores energy substantially only in capacitance, said second switch system causing said energy storage system to electrically disconnect from any conducting circuit when said second switch system is open;

C 1 2
a third switch system that opens and closes a circuit between the capacitive load and a substantially constant second voltage potential, the second voltage potential being different from the first voltage potential; and

a controller communicating with said first, second and third switch systems and causing said switch systems to close and open in a sequential fashion such that the magnitude of the voltage that is delivered to the capacitive load increases and then decreases in a staircase manner;

whereby energy that is delivered to the capacitive load is recovered during decreases in the magnitude of the voltage, and

whereby the recovered energy is always stored substantially only in capacitance and is substantially re-delivered back to the capacitive load during increases in the magnitude of the voltage, thus effectuating energy conservation.

REMARKS

Applicant again thanks the Examiner for the courtesies he extended during the telephone interview on April 6, 2000.

Claims 1-81 are now pending.

In the Office Actions that was mailed on January 24, 2000, and the Supplemental Office Action that was mailed on February 15, 2000, the Examiner rejected Claims 1-80 under 35 U.S.C. § 103(a) as being unpatentable over Applicant's admitted prior art in view of Masuda et al.

On March 30, 2000, Applicant's attorney faxed the Examiner a letter, a proposed new Claim 81, and remarks which explained why the new proposed Claim 81 overcame the Examiner's rejection.

On April 6, 2000, the Examiner agreed during an interview with Applicant's attorney that